

Primary Dendrite Array: Observations from Ground-based and Space Station Processed Samples

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Influence of natural convection on primary dendrite array morphology during directional solidification is being investigated under a collaborative European Space Agency-NASA joint research program, “Microstructure Formation in Castings of Technical Alloys under Diffusive and Magnetically Controlled Convective Conditions (MICAST)”. Two Aluminum-7 wt pct Silicon alloy samples, MICAST6 and MICAST7, were directionally solidified in microgravity on the International Space Station. Terrestrially grown dendritic monocrystal cylindrical samples were remelted and directionally solidified at 18 K cm^{-1} (MICAST6) and 28 K cm^{-1} (MICAST7). Directional solidification involved a growth speed step increase (MICAST6-from 5 to 50 mm s^{-1}) and a speed decrease (MICAST7-from 20 to 10 mm s^{-1}). Distribution and morphology of primary dendrites is currently being characterized in these samples, and also in samples solidified on earth under nominally similar thermal gradients and growth speeds. Primary dendrite spacing and trunk diameter measurements from this investigation will be presented.

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